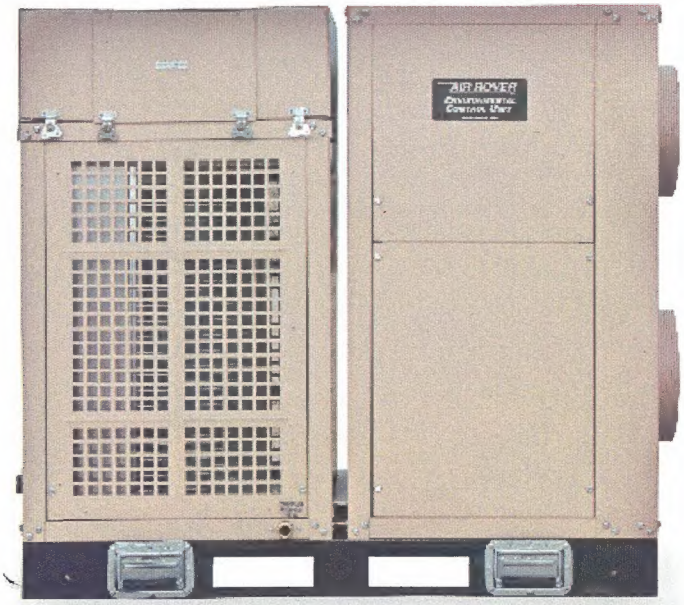
AIR ROVER® INC.

Air Rover® UL Series
Environmental Control Units

OPERATION AND MAINTENANCE MANUAL

Model ULCR24BA



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Air Rover® UL Series
Environmental Control Units

Operation and Maintenance Manual (Revision 04)

Printed in the U.S.A.

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WARNINGS

The following are warnings, which do or do not reoccur throughout this manual. These warnings shall be observed at all times to prevent actions that could cause serious personal injury, death or substantial damage to the unit.

WARNING I

Input power to the ECU MUST be disconnected prior to performing any internal maintenance procedure. Voltages used to operate the ECU can be LETHAL. Simply shutting down the ECU at the control panel does not interrupt power the ECU. DO NOT PERFORM SERVICING OR ADJUSTMENT ALONE Under no circumstances should any personnel reach into an enclosure for the purpose of servicing or adjusting the unit, except inthe presence of someone who is the direct position of providing assistance.

WARNING II

To avoid the risk of fire or explosion, never use oxygen, high pressure air or flammable gases for leak testing of the unit's refrigeration system.

WARNING III

This system uses R-134a refrigerant, which has high operating pressures. No other refrigerant may be used in this system. Gauge set, hoses, and recovery system use for operation and servicing taks shall be designed to handle R-134a. If unsure, consult the equipment manufacturer. Do not overcharge the system with refrigerant. Do not operate unit in a vacuum or at negative pressure. Failure to follow proper procedures may lead to unit damage, personal injury or death.

WARNING IV

Direct contact with refrigerant being discharged from unit (after compressor burnout) shall be avoided, because acid in refrigerant can cause burns.

WARNING V

It is recommended to wear approved personal protective equipment when using compressed air. Provide proper protection from flying particles. Air pressure is restricted to less that 30 psi. Do not direct air stream towards self or other personnel.

WARNING VI

Sheet metal parts may have sharp edges or burs. Care shall be taken when handling sheet metal parts of unit and personnel shall wear appropriate protective clothing and gloves when handling those parts to avoid injury.

SAFETY PRECAUTIONS

The following are recommended safety precautions that personnel operating or servicing this environmental control unit should understand and apply at all times during operation or maintenance service.

KEEP AWAY FROM LIVE CIRCUITS

Personnel shall observe all applicable safety precautions at all times. Do not perform any removal or replacement of component while the unit power is turned on. Electrical hazard may still exist on unit even when power switch is set to OFF position. Always remove power by disconnecting power cable to avoid injury to personnel. Use test tools to ensure that high voltage circuits are at ground before touching them.

DO NOT PERFORM SERVICING OR ADJUSTMENT ALONE

Under no circumstances should any personnel reach into an enclosure for the purpose of servicing or adjusting the unit, except in the presence of someone who is in the direct position of providing assistance.

RESUSCITATION

Personnel working with or near high voltage systems should be familiar with modern methods of resuscitation such as administrating CPR. Information on CPR can be obtained from local Red Cross or American Heart Association.

UNUSUAL CONDITIONS

When an unusual condition is observed and none of the procedures mentioned in this manual specifically relate to the noted condition, work shall be stopped immediately. Properly trained and qualified personnel shall provide guidance on any unusual condition before work can be carried out.

LIFTING OPERATIONS

Extreme care shall be taken when lifting or moving the unit. Use a forklift or crane, and stay clear during lifting procedure. If carried by hand, the unit is designed to be hand-lifted by four people and extreme care shall be taken while hand carrying the unit.

VENTING REFRIGERANT

The US Clean Air Act Amendment of 1990 prohibits venting refrigerants in the atmosphere. This is aimed to reduce the use and emissions of such substance to the lowest level possible and maximize recovery and recycling of them. Following new standards for a safe disposal, all refrigerants must be reclaimed in a safe container for further recycling or safe disposal.

SMOKING AND OPEN FLAMES

Smoking or open flames should be prohibited within 50 feet of refrigerant vapors.

HIGH PRESSURE SYSTEM

The unit is designed with a high-pressure refrigeration systems. Do not open, close or adjust valves in the system, unless a specific instruction calls for such procedures. Doing so without specific instructions could lead to injury or damage to the unit.

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Chapter 1

Introduction

1.1 GENERAL INFORMATION

This operation and maintenance manual specifies Air Rover's Ultra-Lite Constant Run Environmental Control Unit, model ULCR24BA. This Environmental Control Unit (ECU) is a versatile system designed to operate in high ambient conditions of up to 150°F. The purpose of the ECU is to provide cooling, heating and ventilation to equipment and personnel in enclosed areas such as tents, military shelters, satellite communication (SATCOM) systems, military vehicles, radar sites, medical trailers, aircraft hangars, mess halls, shipboard, helicopters, aircrafts (pre-flight), underground facilities, ground support, unmanned aerial vehicles, etc.

1.2 DESIGN SPECIFICATIONS

Performance

Cooling Capacity at 80°F dry bulb, 67°F wet bulb, 95°F ambient.....24,000 BTU/Hr
Cooling Capacity at 80°F dry bulb, 67°F wet bulb, 120°F ambient.....21,500 BTU/Hr
Heating Capacity .....N/A
Operating Conditions .....50°F to 150°F
Evaporator Supply Air Flow..... 800 CFM
Condenser Exhaust Air Flow.....1600 CFM

Electrical

Operating Voltage.....208-230 Volts
Phase, Frequency.....1-phase, 60Hz
Maximum Operating Current (cooling mode).....24.1 Amps
Maximum Operating Current (heating mode).....N/A
Maximum Power Consumption (cooling mode).....5 kW
Supply Wire Size (AWG).....10 AWG
Circuit Breaker.....25 Amps
Electric Heat..... N/A

Physical Characteristics

Dimensions (H x W x D)..... 42in x 24 in x 45 in
Weight .....308 lbs
Fan Type, Evaporator.....Direct Drive
Fan Type, Condenser.....Direct Drive
Supply Air Duct..... .....12 in
Return Air Duct.....12 in

Refrigerant

Type.....R-134a
Charge.....54 oz

1.3 FEATURES

1.3.1 Standard Features

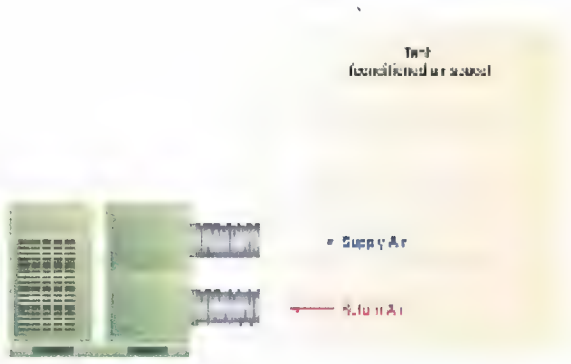
- Operates in high ambient conditions of up to 150°F;
- Designed with automatic bypass operation and constant run refrigeration system;
- Designed to operate with environment-friendly R-134a refrigerant;
- Designed with lightweight aluminum cabinet;
- High-efficiency Copeland® scroll compressor;
- Hot gas bypass for frost and low ambient control;
- Heavy duty motors with thermal overload protection;
- Painted with durable powder coat finish;
- Electronic thermostat temperature controls;
- Has remote control box with 20-ft control cable;
- High efficiency microchannel condenser coil;
- Sound attenuation insulation for quiet operation;
- Permanent washable metal filters;
- External low and high pressure charging ports;
- Designed with stainless steel skid handles and integrated fork pockets for easy deployability;
- Designed with corner quick receivers for optional wheel kits, lifting rings and leveling stands that slide and pin into position in seconds;
- Designed to be deployed four different ways as shown in Fig.1-1.

1.3.1 Optional Features

- Automatic change-over controls
- Dehumidification/reheat
- CARC paint finish
- Ruggedization for MIL-STD-810F compliance
- EMI Shielding

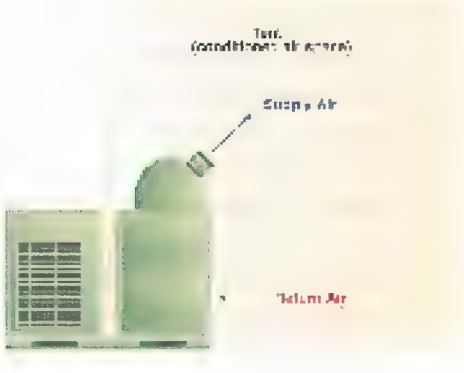
1. Outside Ducted

- Widely used method for tent cooling
- Supply and return air duct openings allow efficient cooling
- Cool two tents with an optional dual supply and return duct panel



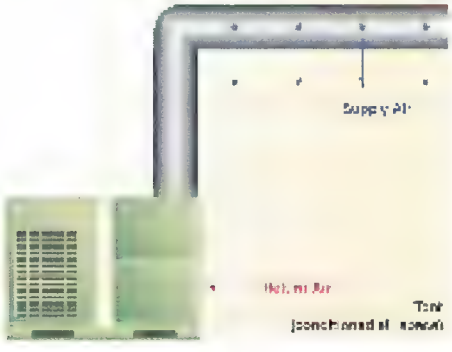
2. Split System

- Fastest deployment, 10 minutes
- Most economical, no duct required
- No loss of cooling in long ducts
- Less sand and dust infiltration
- Slide tent wall between two sections of ECU, and cool.



3. Split Tent Inside plenum

- No outside duct
- Three-step deployment:
  1. Slide tent wall between two sections of ECU
  2. Swap two panels on unit
  3. Add inside duct plenum.



4. Trailer-mounted

- ECU integrated with quiet generators and rugged HUMVEE-towable trailers
- Lower overall weight
- Duct and tent storage.

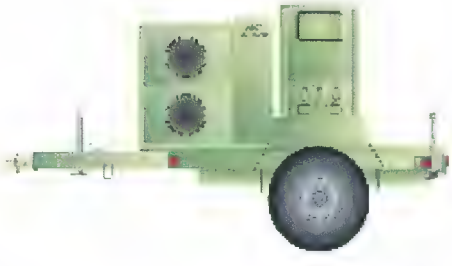
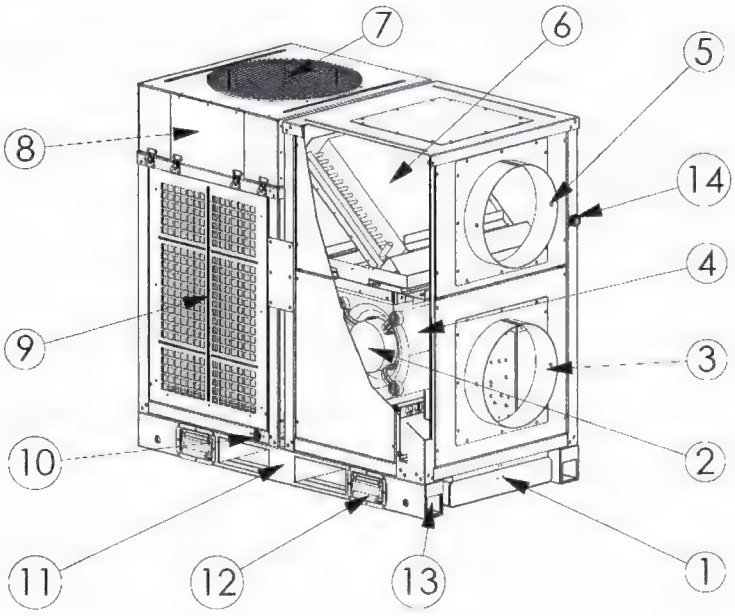
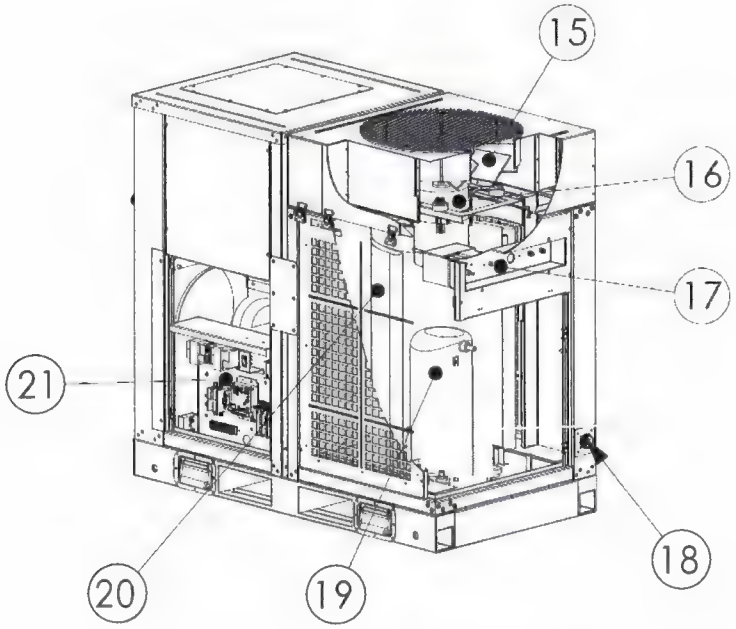


Figure 1-1. ECU deployment methods

1.4 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



EVAPORATOR SIDE VIEW



CONDENSER SIDE VIEW

Figure 1-2. Major components locations

—1. ***Remote Control Cable Storage:*** stores the remote control cable.
—2. ***Evaporator Motor:*** drives the evaporator centrifugal blower.
—3. ***Evaporator Return Air Duct Takeoff:*** connects to evaporator return air duct.
—4. ***Evaporator Centrifugal Blower:*** draws return air into the evaporator section from the evaporator coil and exhausts it through the evaporator supply section into the conditioned space.
—5. ***Evaporator Supply Air Duct Takeoff:*** connects to evaporator supply air duct.
—6. ***Evaporator Coil:*** provides heat exchange by absorbing heat and moisture from the conditioned space by converting the liquid refrigerant (flowing through its tubes) into vapor.
—7. ***Condenser Air Exhaust Grille:*** provides personnel protection from injury.
—8. ***Remote Control Box Storage:*** stores the ECU remote control box.
—9. ***Condenser Air Intake Filter Doors:*** secures condenser intake filters and coil.
—10. ***Condensate Drain Hose End:*** Allows the consendate liquid collected by the drain pan to be drained outside.
—11. ***Skid mount:*** base of the ECU,designed with stainless steel handles, fork pockets and corner quick receivers.
—12. ***Stainless Steel Handle:*** provides means for hand-lifting the ECU.
—13. ***Corner Quick Receiver:*** provides options for wheels, lifting rings and leveling stands.
—14. ***Remote Control Box Connector:*** provides input and output control signals from the remote con trol box.
—15. ***Condenser Fan:*** draws air through the condenser coil and discharges heat (hot air) to the outside.
—16. ***Condenser Motor:*** drives the condenser fan.
—17. ***Service Box:*** contains circuit breaker for power disconnection, high pressure reset switch, sight glass, high and low pressure service ports.
—18. ***Power Input Receptable:*** Receives 208/230V power from the utility or generator source.
—19. ***Compressor:*** a scroll type compressor that pumps refrigerant through the system during cooling process.
—20. ***Condenser Coil:*** provides heat exchange by converting hot gas into liquid refrigerant.
—21. ***Electrical Box:*** contains electrical devices that provide power and control signals to the ECU.

Chapter 2

Installation

2.1 INTRODUCTION

This chapter contains information required to properly install and prepare the Air Rover ULCR24BA ECU and its related accessories.

2.2 UNPACKING AND INSPECTION

Prior to deploying the ECU, make sure to check for possible damages to the crate. After opening the crate, carefully inspect each item included for freight damage, which may have occured during shipment without necessarily causing damage to the crate. Check for the following items to be included in the crate:

1. ECU
2. Remote Control Box
3. Remote Control Cable
4. Power Cable
5. Operation and Maintenance Manual

2.3 ELECTRICAL

All installations should be completed in accordance with the local electrical code. The unit should be connected to supply source with copper wires only. Aluminum wire is to be avoided!

The power supply should be 60 Hertz, 208 or 230V, 1-phase with the required amperage as called for in the appropriate wiring diagram (Appendix A). The wiring diagram fully illustrates the internal wiring and power supply. Supply voltage must be within +10 or -5% of the unit rated operating voltage.

Run power supply to the unit box using the power cord supplied with the unit or, in the case of hard-wired units, with field supplied wiring as called for on the unit data plate (MCA[1]) or the appropriate wiring diagram (wiring diagrams are also located on each unit behind the electrical box access panel).

NOTE: All wiring to the unit must comply with N.E.C. and local codes.

2.4 SYSTEM CHECKOUT

- Check that the power cable has been connected to a source of 208 or 230 Volts, 1 phase, 60 Hertz;
- Check that the evaporator supply and return dust covers have been removed and, if applicable, check that the supply and return ducts have been connected;
- Check that the condensate drain is clear (open or piped to an appropriate location with a proper drain system);

1 MCA: Minimum Circuit Ampacity

2.4 SYSTEM CHECKOUT (Continued)

- Remove the remote control box and remote control cable out of their respective storages and connect the remote control box to the ECU;
- Remove the service box cover (if applicable) and turn the circuit breaker on;
- On the remote control box, set the mode selector switch to either VENT or COOL and turn the system power switch to ON;
- Check that the system power light is on (green)
- If the mode selector is set to VENT, only the evaporator motor should run.
- If the mode selector is set to COOL, the condenser and evaporator motors should run. After a 30-second delay, the compressor should start running.
- If the ECU fails to operate, refer to Chapter 8 for troubleshooting.

NOTE: All installations must be made in accordance with local electrical, heating, air conditioning and plumbing codes. National codes should be followed where local codes do not supersede. The local installer is responsible for knowing the local requirements, and for performing the installation accordingly.

Chapter **3**

Principles of Operation

3.1 GENERAL INFORMATION

All thermostatic controls and indicators are located on the remote control box (Fig. 3-1a). The service box (Fig.3-1b), which contains the power circuit breaker, refrigerant sight glass, manual reset high pressure switch, high and low pressure charging ports, and and emergency cooling switch in case of thermostatic control box failure. The ECU system is designed to be operated using thermostatic remote control box . The thermostatic remote control box can be used with supplied control cable of 20 feet or more from where the ECU is deployed.

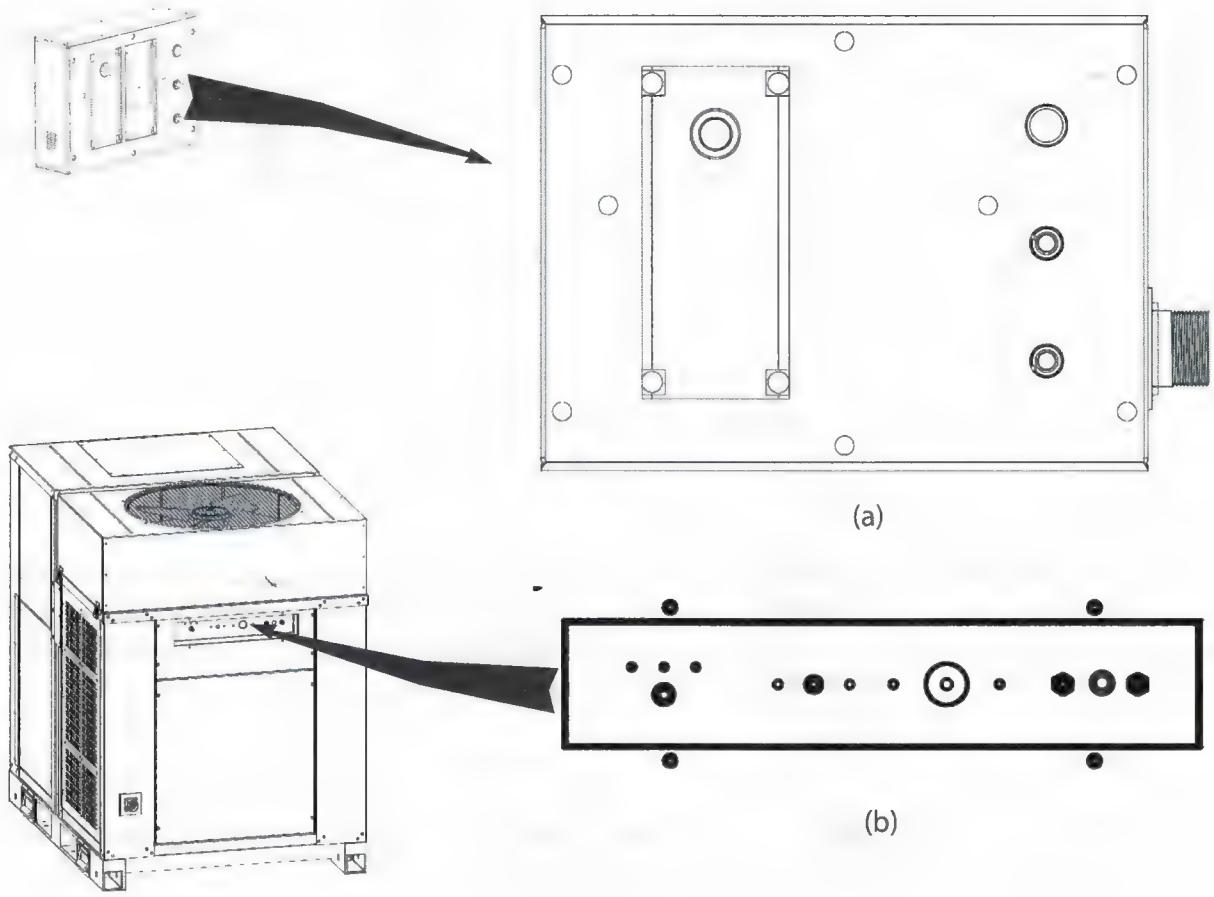


Figure 3-1. (a) Remote control box, (b) Service box

3.2 CONTROL AND MODES OF OPERATION

3.2.1 System Power Switch

The ECU is turned on by turning the on-off system power switch to the ON position. To turn off power to the unit, simply turn the system power switch down to the OFF position.

3.2.2 Mode Selector Switch

The mode selector switch consists of three positions: COOL, VENT and HEAT.

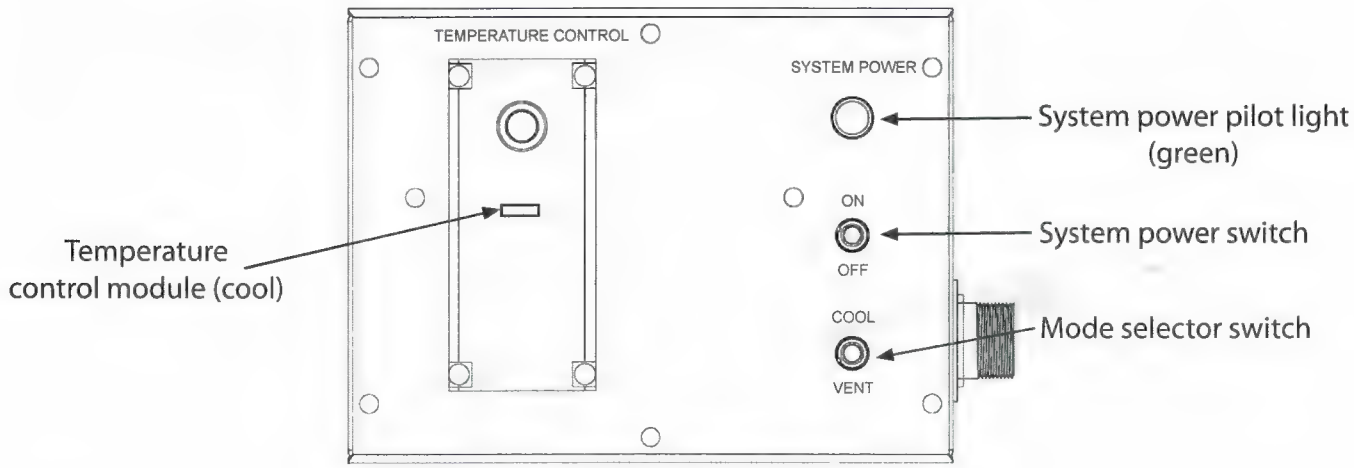


Figure 3-2. Remote control box panel

i. COOL

When the mode selector switch is set to COOL position the ECU will automatically start and operate to cool the conditioned space. In this mode, first the evaporator blower and condenser fan start operating, then the compressor turns on after a delay of 30 seconds to prevent or minimize possible current surges that may occur if all three loads are started up simultaneously.

ii. VENT

When the mode selector is set to VENT the evaporator fan runs continuously, circulating filtered air through the controlled area, with cooling not being operated.

3.2.3 Themorstatic Controls

The ECU remote control box is equipped with a System 350 electronic control module, which is a proportional plus integral temperature control with analog 0 to 10 VDC and 0 to 20 mA outputs. The control is equipped with three user-selectable time integration constants and factory adjustable throttling range of 2 to 30°F.

i. Operation

The System 350 temperature control module operates on 24 VAC/VDC and provides two simultaneous analog outputs: 0 to 10 VDC and 0 to 20 mA. A cover-mounted,10-segment Light-Emitting Diode (LED) bar graph indicates percentage of output. Adjustable features of the temperature control module include:

- Setpoint
- Minimum output
- Throttling range (proportioanl band)
- Selectable integration time constant
- Selectable Reverse Acting or Direct Acting mode of operation

ii. Minimum Output Adjustment

The minimum output adjustment sets the minimum voltage or milliampere output provided by the A350P control. It can be adjusted from 0 to 60% (0 to 6 VDC or 0 to 12 mA) of the output range (See Figure 3-3).

Make the adjustment at the minimum output potentiometer marked as MIN OUTPUT (See Figure 3-3). For each 10% increase in output, the next bar on the LED indicator will light (only one bar is lit at any time).

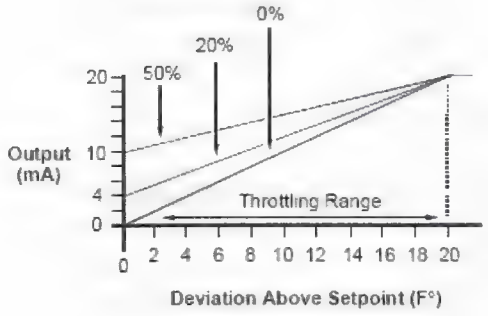


Figure 3-3. Output vs. Deviation from Setpoint

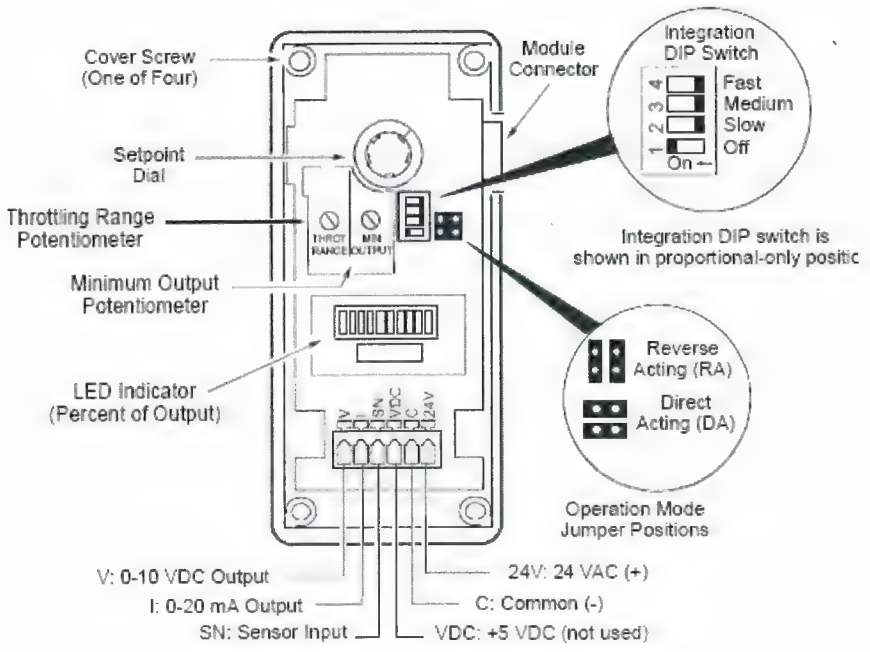


Figure 3-4. System 350 Temperature Control Module board layout and terminal locations

iii. Throttling Range (Proportional Band)

The throttling range is the range over which a control is active. Throttling range for the A350P control can be adjusted from 2 to 30F° (1 to 17C°). Make the adjustment at the throttling range potentiometer marked THROT RANGE (See Figure 3-4). The throttling range is set in factory at 3°F.

iv. Intergration Function

Proportional-only controls cannot hold a process at the exact setpoint. A proportional offset is always present because the control output is 0% at setpoint. Any load on the system will cause the control point to be offset from the setpoint. The greater the load on the system, the further the control point will be offset from the setpoint. (This is commonly referred to as proportional offset, and under maximum load this error will approach the throttling range.)

v. Reverse or Direct Acting Operation

With the operation jumpers in the Reverse Acting (RA) position, the analog output increases as the temperature drops below setpoint (See Figure 3-5). With the operation jumpers in the Direct Acting (DA) position, the analog output will increase as the temperature rises above the setpoint. Select the RA/DA mode by positioning the operation jumpers vertically or horizontally (See Figure 3-4). Position the operation jumpers vertically for RA and horizontally for DA. The RA/DA operation jumpers are installed in the DA mode at the factory.

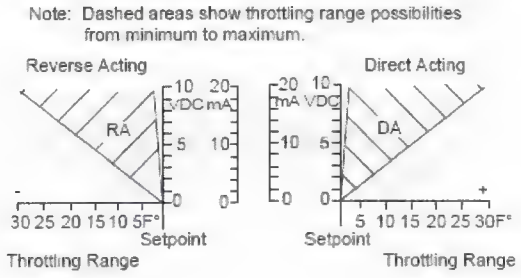


Figure 3-5. RA and DA Proportional Bands Shown in Proportional-Only Mode

v. Heating Mode Operation (if applicable)

With Heating mode selected, the differential is below setpoint. The S350A On-Off stage module receive power, setpoint, and sensor input from the A350P control and perform switching functions based on the control's setpoint and sensor information, as well as the offset and differential selected at the S350A stage module.

NOTE: Unit cannot be operated in heating and cooling modes at the same time.

3.2.4 Indicators

Table 3-1 lists the visual indicators used on the ECU. See Figure 3-1 for location of each indicator.

Table 3-1. List of ECU indicators and their functions

Indicator	Function
System Power Light	When lit, indicates that ECU power is on
Temperature Control Module LEDs bar	When lit, indicates that ECU is in COOL mode (percentage of output)
Stage Module LED (If applicable)	When lit, indicates that ECU is in HEAT mode
Refrigerant Level Sight Glass	Provides a true moisture indication for refrigerant: • Dark green indicates dry. • Bright yellow indicates wet. • Chartreuse indicates that moisture content is approaching an undesirable or "caution" level. • Bubbles indicate a shortage of refrigerant or a restriction in the liquid line.

CAUTION

Do not operate the ECU in COOL mode if the refrigerant color has turned yellow or reached the "unacceptable" level or if a significant amount of bubbles appear in the sight glass. COOL mode operation can also proceed with the refrigerant color in the chartreuse band or with only an occasional bubble appearing in the window, but the sight glass should be rechecked on a hourly basis during operation to ensure that the condition has not worsened.

Chapter **4**

Operation

4.1 GENERAL INFORMATION

Refer to *Section 2.4 System Checkout* to ensure that the ECU is checked and ready to be operated. To optimize comfort and save energy (during cold or warm weather):

- Limit traffic through doors of conditioned space as much as possible.
- Keep doors and windows of conditionned space tightly closed.
- Do not adjust the control unnecessarily. Make sure the control is set properly (See Section 3.2) and the ECU will automatically control the temperature as desired.

4.2 OPERATION IN VENTILATION(VENT) MODE

a. Flip the power switch to ON to turn the ECU on.
b. Flip the mode selector switch to VENT position.

4.3 OPERATION IN COOLING (COOL) MODE

a. Flip the power switch to ON (if ECU was turned off).
b. Flip the mode selector switch up to COOL position.
c. Using the System 350 temperature control module, adjust the setpoint. See *Section 3.2 Control and Modes of Operation* for procedures.

Chapter 5

Functional Description

5.1 REFRIGERATION CYCLE

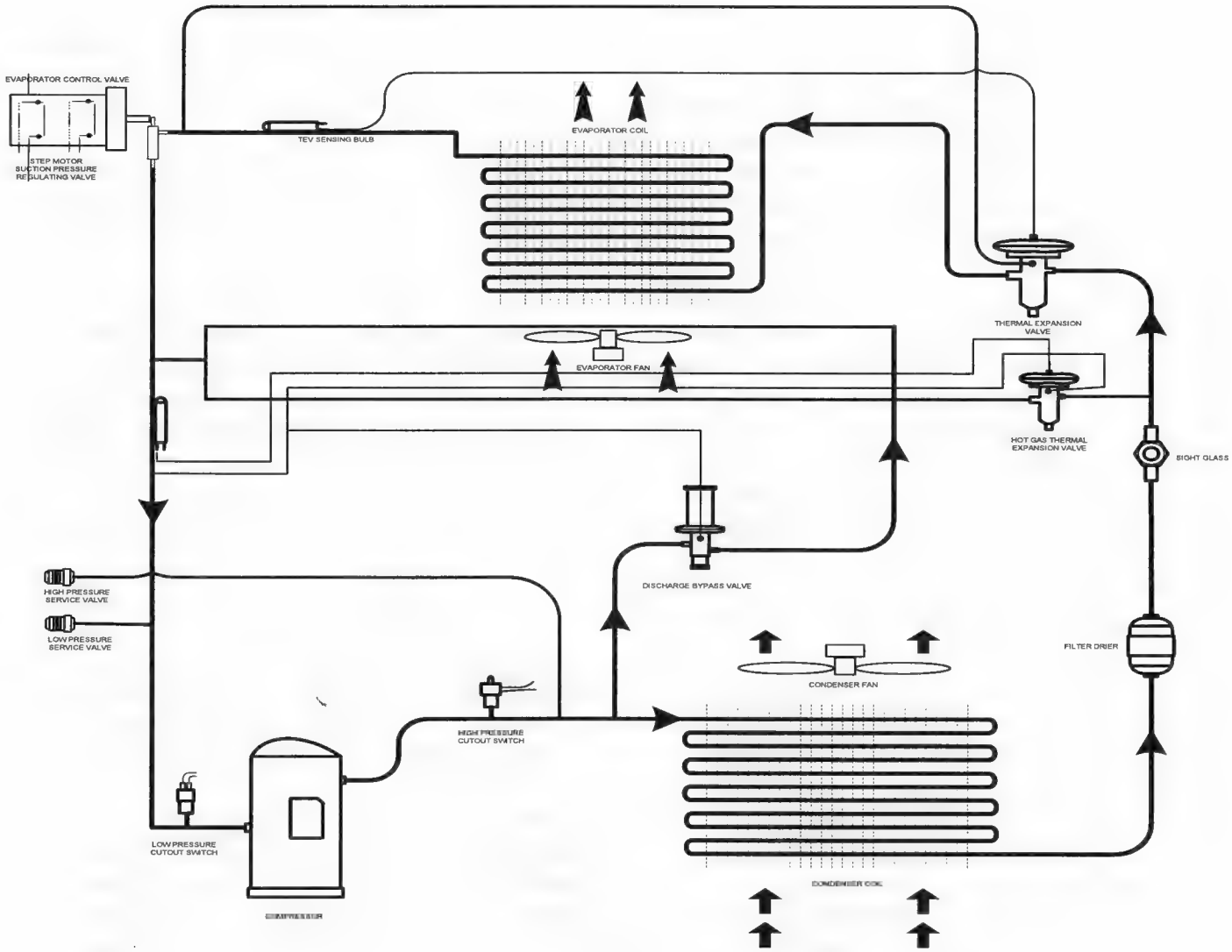


Figure 5-1. Refrigeration schematic

a. Cooling Cycle

The cooling cycle occurs with the mode selector switch set to COOL position and the cooling mode LED on the System 350 control module lit.

- The compressor starts 30 seconds after the system is set to cooling. This delay is to prevent overload and damage to the electrical system during startup.
- The compressor takes cold, low-pressure refrigerant gas and compresses it to a high temperature, high pressure gas. This high pressure gas flows through the copper lines to the condenser coil.
- The condenser fan draws outside ambient air through the condenser coil. The high temperature, high-pressure gas from the compressor is cooled by the flow of air and is converted to a high-pressure liquid.
- The filter drier removes any moisture (water vapor) or particulate contaminant that may be carried by the liquid refrigerant.
- The sight glass indicates the presence of moisture and amount of refrigerant in the system. See Table 3-1 for color indications on moisture level in refrigerant.
- The thermal expansion valve controls the amount and pressure of liquid refrigerant to the evaporator coil. By means of a sensing bulb, the expansion valve senses the temperature and pressure of the refrigerant as it leaves the evaporator coil, and constantly adjusts the flow of liquid refrigerant to it.
- As the liquid refrigerant leaves the expansion valve, it enters the evaporator coil. As the liquid refrigerant enters the coil at a reduced pressure, the reduction in pressure and the warmer air being forced across the coil tubes cause the refrigerant to boil and vaporize, thus converting to a gas.
- The warm air from the controlled space is then circulated by the evaporator blower over and through the evaporator coil. During the vaporization process, liquid refrigerant absorbs heat when it is converted from a liquid to a gaseous state. As return air (from the conditioned space) comes in contact with the evaporator coil, the air is cooled.
- The refrigerant is then drawn back to the suction side of the compressor and the cooling cycle is resumed again.

b. Constant Run Cooling

Air Rover's "CR" ECUs feature constant-run operation that matches the ECU's cooling capacity to the cooling load at hand. This type of operation results in accurate temperature control without the temperature swing caused by unit cycling. Also, since there is no cycling of operation, the in-rush current that results from compressors's cycling is eliminated.

The constant-run operation is achieved by using a modulating refrigeration valve that will force refrigerant to bypass the evaporator coil to reduce cooling. The unit's thermostat sends a 0-10VDC signal, describing how close the set point is to being achieved, to a TCB (temperature control board), which controls the modulating valves position. As the unit's return air approaches the set point temperature, the valve begins to close and refrigerant flow through the evaporator becomes restricted. As the flow becomes restricted, the unit's suction pressure drops and causes a secondary thermal expansion valve to open and allow refrigerant to bypass the evaporator. When the return air reaches the set point, the modulating valve closes completely and stops flow through the evaporator. The amount of evaporating capacity allowed becomes directly proportional to the amount of cooling needed.

c. Cooling in Low Ambient Conditions (if applicable)

Under low ambient conditions the condenser surface is reduced by flooding the condenser with excess refrigerant. The excess refrigerant is stored in the receiver when not required in the condenser.

Figure 5-2 shows a Single valve flooded system. The standard valve used by Air Rover is nonadjustable and fixed at 100 PSI, and designed for scroll compressor applications with R-134a refrigerant.

As shown in Fig. 5-2, flow enters Port C and exits Port R at condensing pressures above the valve setting. When the condensing pressure falls below the valve setting, the valve modulates to permit discharge gas flow through Port D. As the three-way valve opens Port D, Port C closes proportionately.

The reduced opening at Port C restricts liquid refrigerant flow so that the liquid level in the condenser rises. The valve modulates maintaining a constant pressure in the receiver at the valve setting and sufficient liquid in the condenser to maintain that pressure.

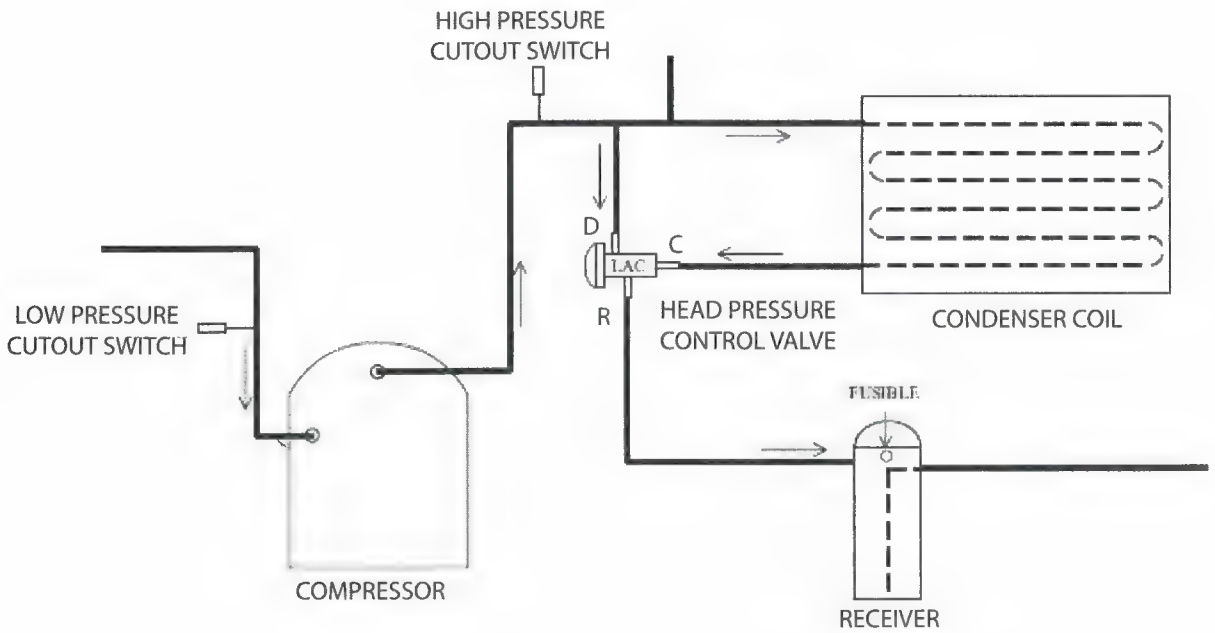


Figure 5-2. Single valve flooded condenser system

There are two main advantages of using this method of head pressure control over the pressure fan cycling method:

—1. A constant and stable minimum head pressure placed on the surface of the liquid level of the receiver prevents the loss of efficiency experienced with pressure fan cycling due to expansion valve hunting.
—2. Since the condenser is flooded during operation below the valve pressure setting, liquid sub-cooling is increased. However hot gas is injected directly into the vapor side of the receiver, warming the liquid in the receiver. The liquid temperature can easily be maintained within the minimum design operating range (minimum design liquid pressure and temperature) of the expansion valve and nozzle.

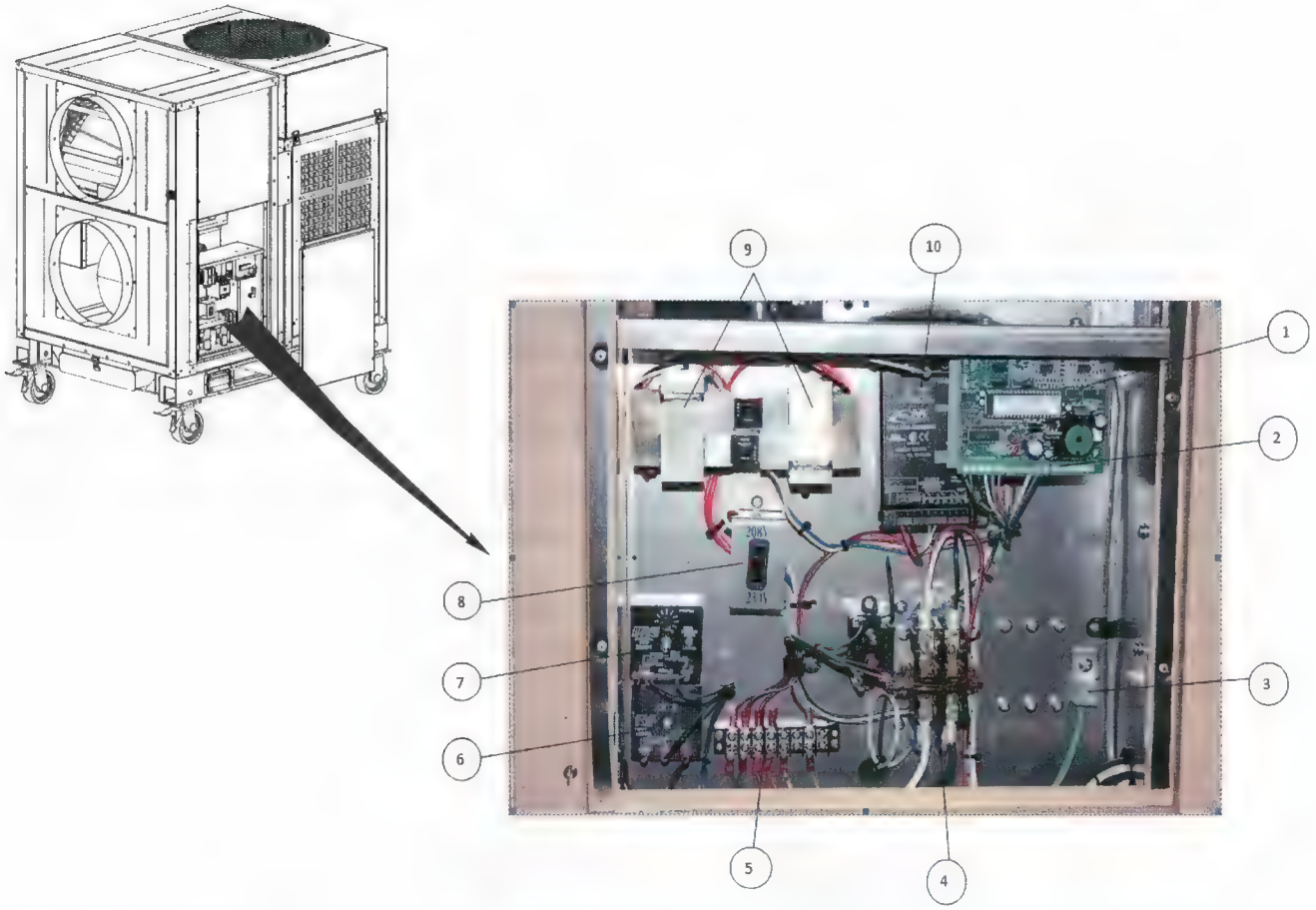
CAUTION

1. A system should never be charged to levels that exceed 90% of the receiver capacity.
2. The valve's pressure setting is not field-adjustable.

5.2 ECU CONTROL COMPONENTS

5.2.1 Location and Description of Control Components

Figure 5-2 shows the location of the electrical box and the components layout.



1- Temperature control board
2- Head pressure control board
3- Ground lug
4- Compressor control
5- Low voltage distribution block
6- Bypass timer
7- Time delay relay
8- 208/230V switch
9- Control transformers
10- Low ambient control

Figure 5-2. Electrical box components

—1. ***Temperature control board:*** allows control of evaporator control valve, using 0-10V signal from the temperature control module;
—2. ***Head pressure control:*** regulates the system pressure by slowing down the condenser fan mo tor, under low ambient conditions;
—3. ***Heat sequencer:*** allows the electric heat elements to come on and go off in a certain timed se quence. The delay in timing prevents the overloading of of the ECU with large power load all at once.
—4. ***Ground lug:*** provides ground connection point to the unit's metal frame;
—5. ***Power distribution block:*** allows the routing of 208/230V power from the power input source to control components;
—6. ***Control transformers :*** step down control transformers, which provides 24V AC output control signal to the temperature control module and control components in the eletrical box;
—7. ***208V/230V rocker switch:*** allows the transformer to step down either 208V or 230V source power for 24V controls;
—8. ***Bypass timer:*** when the unit starts in low ambient conditions, bypasses the low pressure switch for 4 minutes to allow pressure to build up;
—9. ***Time delay relay:*** delays the compressor startup period for 30 seconds to prevent overload and minimize inrush current when the unit is started up;
—10. ***Low voltage distribution block:*** allows the routing of 24V control signal from the transformer to control components (relay and contactor coils, control switches and thermostat);
—11. ***Emergency cool relay:*** switches on or off to allow emergency cooling to occur incase of remote box failure or lost;
—12. ***Temperature control board pumpdown relay:*** switches on or off to allow the evaporator control valve's pumpdown to happen. When "shorted" the valve will close and remain closed. When "open" the valve will control normally.
—13. ***Evaporator fan relay:*** switches on or off to provide power to the evaporator fan motor;
—14. ***Compressor/condenser fan motor contactor:*** switches on or off to provide power to the com pressor and condenser fan motor;

5.2.2 Head Pressure Control

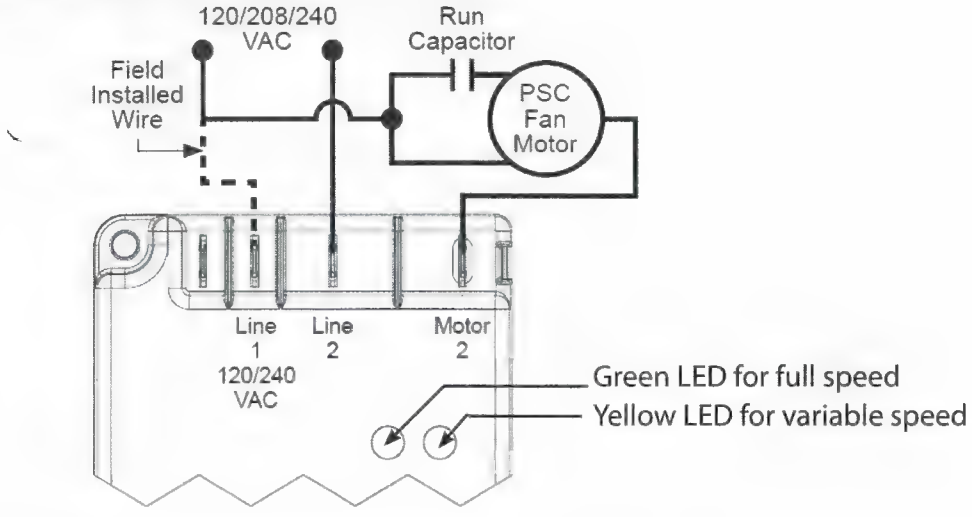


Figure 5-3. Head pressure control wiring to condenser fan motor

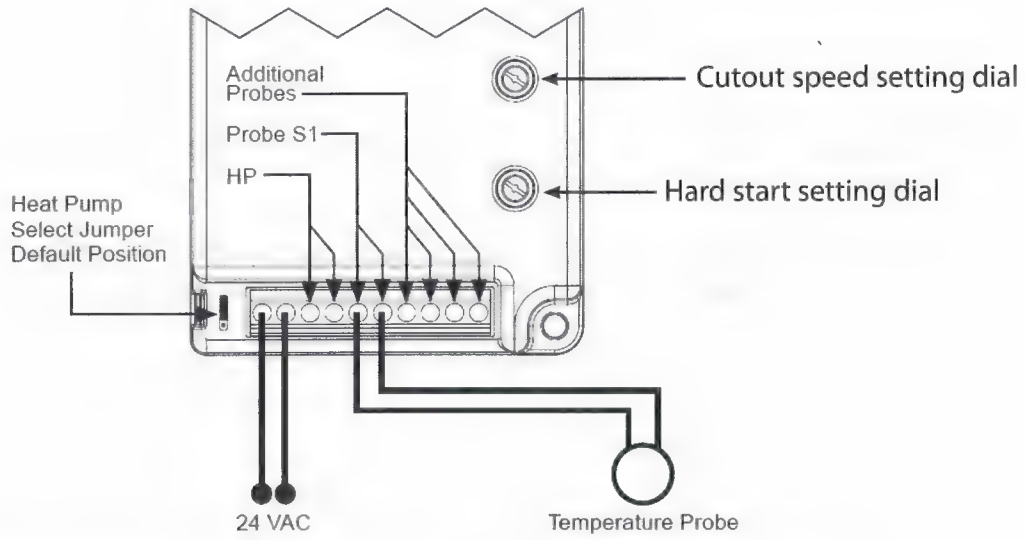


Figure 5-4. Head pressure control power source and temperature probe wirings.

With probe temperatures above 100°F, the control applies full voltage to the motor. The green light is illuminated (full speed LED). With probe temperatures between 70°F and 100°F, the motor speed is proportional to the probe temperature. The yellow light is illuminated (variable speed LED). When the motor starts at temperatures between 70°F and 100°F, it will hard start for the length of time dictated by the hard start dial setting. After the hard start time has elapsed, the motor speed is controlled by the probe temperature. As the temperature being sensed decreases, the output voltage decreases. The output voltage may decrease to the determined cutout speed dictated by the cutout speed dial. Upon reaching the cutout speed setting, the output voltage goes to zero volts. System restart will occur when the temperature exceeds 70°F. With probe temperatures below 70°F, the motor remains off. The green light and the yellow light are off.

i. Setting the cutout speed

The cutout speed dial adjusts the motor voltage range. Set the cutout voltage dial (See Fig. 5-5a) according to the type of motor you have.

1. Sleeve Bearing Motors: Set the cutout speed dial to the middle of the sleeve bearing range. In this range, the motor can run down approximately 40-50% of the full line voltage, which allows sufficient RPMs for cooling and lubrication.

CAUTION

With sleeve bearing motors, it is important not to adjust outside the sleeve bearing range or bearing failure may result.

2. Ball Bearing Motors: Set the cutout speed dial to the MIN position in the ball bearing range. This position offers the greatest range of speed control. At the MIN setting the motor can run down to approximately 20-30% of the full line voltage.

NOTE: After starting at the recommended settings for either sleeve or ball bearing motors, you can fine tune the cutout speed to achieve the desired results.

ii. Setting the hard start time

During the Hard Start mode, full voltage is applied to the motor during startup to overcome windmilling and to lubricate the bearings.

The position of the hard start dial (See Fig. 5-5b) determines the time period of the hard start mode. The dial can be adjusted between 0.1 second and approximately 5 seconds.

Set the hard start dial according to the type of motor you have. If you have a ball bearing motor, set the hard start dial to the MIN position. If you have a sleeve bearing motor, set the hard start dial to the middle of the sleeve bearing range.

After you begin at the recommended setting, you can fine tune the hard start time within the recommended range for the type of motor you have.

It is recommended that you use the minimum possible hard start time to avoid blowing too much cold air over the condenser.

Hard Start mode is activated when 24 VAC is applied (or disconnected and re-applied) or the probe temperature increases to above 70°F. The hard start mode applies full voltage to the motor for the set time period. Afterwards, the motor speed is dictated by the temperature sensor.

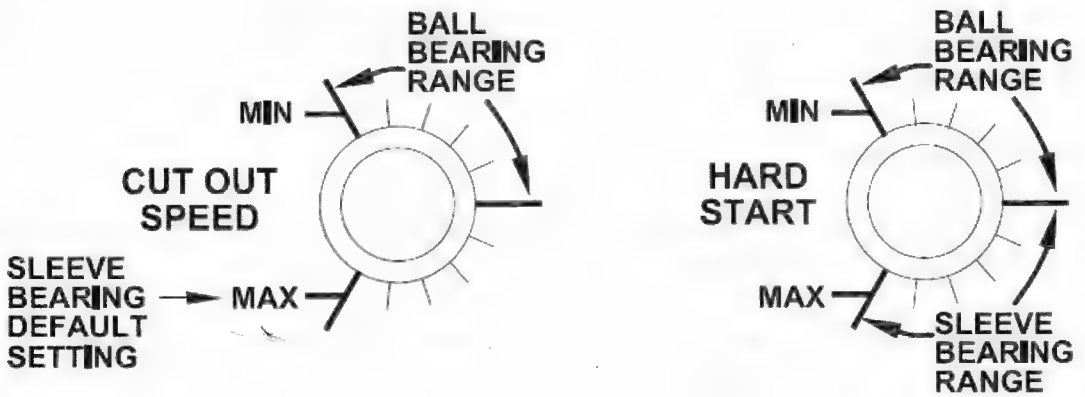


Figure 5-5. Cutout speed (a) and hard start setting (b) dials

Chapter **6**

Preventive Maintenance

6.1 GENERAL INFORMATION

Preventative Maintenance Checks and Services (PMCS) are essential to ensure that the envinromental control unit is ready for operation in any mode at all times. The purpose of a preventative maintenance program is to discover and correct defects before they can cause serious damage or complete failure of the equipment. An effective preventative maintenance program must begin with training all operators to report to unit maintenance all unusual conditions noted during daily checks or actual operation. All defects discovered during maintenance inspections must be recorded together with the corrective action taken. The paragraphs below identify and explain the columns used in the PMCS table:

a. **Item No.** : Number in this column are used for reference

b. **Interval** : This column of the PMCS table tells when to perform a certain check or service (Before, During, and After)

c. **Item to be Inspected** : This column of the PMCS table provides the location and the item to be checked or serviced.

d. **Procedure** : This column of the PMCS table explains how to perform the required checks and services and which trained personnel is responsible for each check or service. These instructions should be carefully followed.

e. **Equipment (ECU) Is Not Ready/Available if** : This column specifies when and why the equiment cannot be operated.

Table 6-1. Operator Preventive Maintenance Checks and Services

B = Before, **D** = During, **A** = After, **W** = Weekly, **M** = Monthly

Item No.	Interval					Item to Be Inspected	Procedure	Equipment (ECU) Is Not Ready/Available If
	B	D	A	W	M			
1	X					Evaporator and duct takeoff covers	Check that covers are removed.	
2	X X				 X	Outside covers and panels	1. Check that panels and covers are in place 2. Check panels for cracks, dents, and missing hardware (fasterners)	Panels missing or damage that would lead to hazardous operation of equipment..
3	X				X	Condenser exhaust fan guard (grille) and intake filter doors	Inspect fan guard for obstructions, damage, loose or missing hardware. If loose, secure them.	Missing parts or damage that would lead to hazardous operation of equipment.
4					X	Overall outside surface of ECU	Inspect for cracks, dents in the frame. Check for chipped or missing paint and any evidence of corrosion. Notify maintenance personnel for verification and repair as necessary.	
5	X					Information Plates	Inspect for legibility and loose or missing hardware	
6	X X X	 X			X X	Control Panel	1. Inspect system power switch and mode selector switch for obvious damage. Notify Maintenance if damaged. 2. Inspect for proper operation. 3. Inspect System 350 control module for proper operation.	Control panel damaged. ECU not operating properly. ECU not operating properly

Table 6-1 Operator Preventive Maintenance Checks and Services (continued)

B = Before, **D** = During, **A** = After, **W** = Weekly, **M** = Monthly

Item No.	Interval					Item to Be Inspected	Procedure	Equipment (ECU) Is Not Ready/Available If
	B	D	A	W	M			
7		X X				Refrigerant sight glass	1. Check refrigerant sight glass for constant bubbles indicating low refirgerant. 2. Check center indicator for yellow color indicating presence of moisture.	Sight glass shows bubbles foam or center indicator is yellow.
8		X				Condensate drain hose	In cooling mode, check that liquid water is dripping from the hose end. Notify maintenance if water is dripping from any other place for repair if necessary.	
9				X		Power cord, Remote control cable	Check for frayed or damaged insulation on visible sections of wires. If frayed or damaged, notify maintenance.	Any wire is frayed or damaged
10					X	Air Filters	Remove return air filters and inspect for dirt and other obstructive particales. Clean or replace if necessary.	Intake air filters are dirty enough to cause obstruction to proper air circulation.
11					X	Casters (if applicable)	1. Check frames for distortion, broken welds due to impacts. 2. Check for loose fasteners. 3. Check for bearings lubrication. Apply lubricant to bearings if necessary. 4. Check for loose or corroded swivel assemblies. Replace corroded assemblies if necessary.	

6. 2 PREVENTIVE MAINTENANCE BY MAINTENANCE PERSONNEL

Preventive Maintenance Checks and Services performed by the ECU operators are limited to those listed in Tables 6-1. Table 6-2 below consists of inspections and care procedures to be performed by maintenance personnel in order to keep the ECU in good operating conditions. These procedure are to be carried out only if the ECU is operated periodically, and not when the ECU has been in storage. If the ECU has been in storage and is about to be used, weekly and monthy procedures need to be performed prior to startup.

Table 6-2. Maintenance Personnel Preventive Maintenance Checks and Services

Item No.	Interval	Item to Be Inspected	Procedure	Equipment (ECU) Is Not Ready/Available If
1	6 months	Coils	Check coils for any visible damage or any built up dust, soil, grime and other deposits that might reduce the efficiency of ECU. Replace of clean coils if necessary	Coil dirty or damaged, which can cause reduction in ECU efficiency.
2	6 months	Refrigeration system components, copper tubing and fittings	Inspect components for damage and copper tubing and fittings for leaks.	Refrigeration system components are damaged or copper tubing or fittings have leaks.
3	3 months	Condenser fan and Evaporator blower	Inspect fan and blower for any cracks or obvious damages. Replace if damaged.	Condenser fan and/or blower are/is damaged enough to cause reduced airflow.
4	3 months	Condensate drain line	Inspect condensate drain line for dirt or clogs. Clean if dirty or clogged.	Condensate line is clogged.
5	6 months	Electrical system components	Check electrical components for damage or evidence of wear due to overheating. Replace any damaged component .	Electrical system component damaged or overheated.
6	6 months	Electrical wiring, Cables and Electrical connections.	Check wiring, cables and components connections for cuts, breaks, or frayed insulation. Check for loose connections. Replace missing or damaged terminals if necessary and tighten loose ones.	Any cable or wiring harness is damaged. Any electrical connection is missing, loose or damaged.

Chapter **7**

Service and Repair

7.1 GENERAL INFORMATION

This chapter contains general information on maintenance, service and replacement procedures for the ULCR24BA ECU. These instructions are written under the assumption that the personnel designated to perform them have proper training and have had prior experience in dealing with air conditioning or environmental control unit systems.

7.2 REFRIGERATION SYSTEM

7.2.1 Compressor Lubrication

- Should it ever become necessary to add oil to the compressor, use Polyol Ester lubricant.

7.2.2 Recovering Refrigerant

- Inspect the recovery machine, pressure gauge, and recovery cylinder thoroughly to insure that all these items are in good operating condition, and comply with EPA rules.
- Make sure the pressure gauge is closed. Connect the high and low pressure gauge manifold to the ECU.
- Connect the center (charging) port of the pressure gauge manifold set to the inlet of the recovery machine.
- Connect the output port of the recovery machine to the liquid inlet port of the recovery cylinder.
- Make sure all connections are correct and tight while all the gauges are closed.
- Open the liquid port of the recovery cylinder (always open valves slowly to check hoses and connections for leaks).
- Make sure the recover/purge valve is set on recover, on the recovery machine.
- Open the output port of the recovery machine.
- Open the liquid port on the manifold gauge set; opening the liquid port will remove the liquid from the system first, greatly reducing the recovery time. (After the liquid has been removed, open the manifold vapor port to finish evacuating the system).
- Connect the recovery machine to a power outlet. Switch the main power switch to the ON position, and the fan should start running.
- Slowly open the input port on the recovery machine.
- If the compressor starts to knock, slowly throttle back the input valve until the knocking stops.
- If the input valve was throttled back, it should be fully opened once the liquid has been re moved from the system (the manifold gauge set vapor port should also be opened at this time).

- Run until desired vacuum is achieved, and all refrigerant has been removed.
- Close the manifold gauge sets vapor and liquid ports.
- Close the Recovery machine input port.
- Turn the valve knob Recover/Purge to a purge position on the recovery machine.
- Let the machine run for about one minute to force any refrigerant in the recovering machine to be moved to the recovery cylinder.
- Close the outlet valve of the recovery machine
- Close the inlet port of the recovery cylinder
- Turn off the recovery machine.

7.2.3 Charging Refrigerant

- Before charging the ECU with refrigerant, make sure there is no moisture in the system. If the system is completely empty of refrigerant, there is a possibility of having moisture in the system. In this case, evacuate the system to below 250 Microns before charging the system.
- To charge the ECU, connect manifold pressure gauge to low and high pressure taps.
- Connect the center (charging) port of the gauge to the appropriate refrigerant cylinder on top of a scale.
- Zero the scale and make sure both high and low pressure gauges are closed.
- Open the refrigerant tank.
- Open high pressure side slowly to charge the unit to the appropriate amount of refrigerant specified on the data plate.
- Close the high pressure gauge.
- Close the refrigerant cylinder.
- Remove the gauge and the charging procedure is done.

7.3 STARTUP AFTER REPAIR

CAUTION

Starting compressor with service valves in closed position may cause equipment damage or personal injury.

Refer to Chapter 4 for procedures on starting up the ECU.

7.4 ELECTRICAL WIRING REPAIR AND GENERAL

WARNING

Turn off external power suppy to the ECU and disconnect power cord from the power source prior to performing any maintenance task. Rotating parts and potentially lethal levels of AC power are present is the ECU. Electrical shock can cause injury or even death.

Repairing electrical wiring consists of replacing wires, terminals, connectors and components using apropriate procedures. See Appendix A for the ULCR24BA electrical wiring diagram.

Chapter **8**

Troubleshooting

This Chapter contains troubleshooting procedures and recommended corrective actions to follow in the event of a problem with your air conditioner. In the event of a failure, the first step is to check the electrical power to see if power has been interrupted or a breaker has tripped. The main power switch should be checked to insure it has not been turned off. Failure to perform or poor performance may also be caused by dirty filters and/or obstructed evaporator return and/or condenser intake. If operation is not restored by checking these general items, continue to the procedures below. Table 8.1 contains troubleshooting analysis and corrective action procedures for the ULCR24BA ECU.

NOTE: Do not change adjustment, settings, or components of ECU until the issue is clearly defined and understood. In case of failure to of ECU to start, or the ECU is not functioning correctly, follow these steps:

a. Troubleshoot the issue accurately.
b. Make repair in accordance with approved practices of the electrical , mechanical or HVAC industries.
c. Perform only one change at a time.
d. After each repair is performed, the ECU should be run-tested thoroughly to ensure that the issue was solved.
e. Always check electrical continuity on all electrical and control components prior to re moving any part.

Table 8-1. Troubleshooting and Corrective Actions

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
ECU wil not start	Tripped circuit breaker	Reset circuit breaker
	Broken or loose wire connection	Replace or tighten wires
	Voltage supply low	If voltage is below minimum voltage specied on data plate, contact power company or check generator
	Low voltage circuit (control signal)	Check 24V transformer for burnout, or tripped breaker or volage less that 24V. Change out transformer.
	Defective system power button	Check for continuity, burned or pitted contacts, or mehcanical damage. Replace system power button following standard electrical procedures.
Unit runs but does not cool properly	Unit undersized	Recalculate heat gain or loss for conditioned space. If excessive, rectify by adding insulation, shading, etc.
	Loss of conditioned air due to air leaks in conditioned space.	Check for openings (windows, doors, etc.) in conditioned space.
	Defective thermostat	Replace thermostat
	Temperature control module improperly set.	Set temperature control module properly.
	Airflow	Lack of adequate airflow or improper distribution of air. Check motor speed. Check filter, which should be inspected on a monthly basis and changed if dirty. Remove or add resistance accordingly.
	Defective blower motor	Replace blower motor.
	Defective selector switch	Replace selector switch
	Compressor motor overload	Turn off ECU and allow to reset. If overload, will not reset, replace it.
	Compressor, condenser fan, evaporator blower, contactors.	Check continuity with ohmmeter. Replace if defective.
	Compressor motor	Check compressor motor. If shorted, burned out or defective, replace compressor.
	Wiring to compressor and contactor	Check for loose or missing wiring. Tighten terminals if loose or replace if missing of broken.
	High or low pressure cutout defective.	Replace if defective.
	Clogged air filter	Remove, clean and reinstall air filter.
	Insufficient Refrigerant charge	Check refrigerant level. If low on refrigerant, add liquid refrigerant to proper charge
	Blower motor runs backwards	Reverse wiring
	Temperature Control Board improperly set	Check TCB for proper setting. Replace if defective.

Table 8-1. Troubleshooting and Corrective Actions (Cont.)

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Evaporator blower motor does not run	Excessive amp draw	Refer to data plate. Probe lead wire for amps, if incorrect, replace blower motor.
Condenser fan motor does not run	Open windings	Ohm motor leads to check for open windings or defective run capacitor. Check the run capacitor. Ohm across the run capacitor terminals for short rise in voltage. If no rise or continuous current, replace the run capacitor. If open windings are found, replace the motor.
Compressor does not run	Compressor overload	In all cases an internal temperature sensitive compressor overload is used. If the compressor dome is too hot to touch, the overload will not reset until the compressor cools down. If the compressor is cool and the overload does not reset, there is a defective overload. Replace the compressor.
	Compressor motor grounded	Internal winding grounded to compressor shell. Replace compressor. If compressor is frequently burning out, follow clean-up procedure.
	Compressor windings open	Check conitnuity of compressor windings with an ohmmeter. If windings are open, replace compressor.
	Seized compressor	Compressor goes to lock rotor on initial start. Replace compressor.
	Tripped high pressure switch	Excessive head pressue and restricted condenser airflow. Check for overcharging.
Conditioned air too cool	Temperature control module improperly set	Adjust temperature control module to proper settings.
	Defective temperature control module	Replace temperature control module.
ECU does not heat (if applicable)	Temperature control module improperly set.	Adjust temperature control module to proper settings
	Open thermal limit switch on heater.	Turn ECU off and allow automatic reset.
	Defective thermal limit switch	Replace defective limit switch.
	Heater continuity	Check for burned out heater coils. If burned out, replace heater.
	Heater contactor	Check for continuity and/or loose or broken wiring. If defective, replace contactor.

Table 8-1. Troubleshooting and Corrective Actions (Cont.)

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Discharge pressure too high	Condenser fan not operating	Repair or replace motor or contactor.
	Improper operation of condenser coil, causing insufficient airflow	Clean coil surface and correct airflow.
	Presence of air or non-condensable gas in system.	Evacuate ECU, purge system and recharge with new refrigerant.
	Overcharge of refrigerant. Compressor "slugs".	Evacuate ECU, purge system and recharge with new refrigerant.
Discharge pressure too low	Insufficient regrigerant charge. Sight glass shows bubbles.	Repair leaks and recharge ECU.
	Broken or leaking compressor discharge valve.	Replace compressor.
Suction pressure too high	Expansion valve bulb loose or not properly mounted to suction line. Unusually cold suction line. Complessor "slugs".	Reattach bulb to suction line properly. If trouble continues, replace valve and bulb.
	Expansion valve stuck in open position	Replace valve and bulb.
	Overcharge of refrigerant or non-condensable gas. Discharge pressure too high.	Recover refrigerant. Evacuate ECU and charge new refrigerant.
	Faulty compresor motor. Compressor operating intermittently.	Replace compressor.
	Clogged condenser coil or defective condenser fan. high-pressure switch interrupts compressor.	Clean coil or remove any obstruction to airflow. If defective, replace condenser fan motor.
	High or low line voltage intermittent compressor operation.	Check and correct voltage supply.
Suction pressure too low	Insufficient refrigerant. Bubbles in sight glass.	Repair leak and recharge.
	Expansion valve stuck in closed position.	Replace valve.
	Clogged filter drier. Exhaust line much colder than intake.	Replace filter drier.
Compressor "short cycles"	Temperature control module. Improper settings.	Set temperature control module properly.
	Loose wiring or defective controls	Tighten wiring terminals. Replace controls if defective.
	Compressor overloaded	Check and replace if necessary. If compressor runs too hot, check refrigerant charge and add charge if necessary.
Compressor noisy	ECU out of phase	Correct phasing.
	Excessive discharge pressure	See "Discharge Pressure too high"
	Expansion valve stuck open	Replace valve.
	Lack of oil	Replace compressor.
	Damaged internal components	Replace compressor.
	Worn bearings	Replace compressor.

Table 8-1. Troubleshooting and Corrective Actions (Cont.)

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Noisy ECU operation	Compressor	Make sure compressor is not in direct contact with the base or sides of cabinet. The hold–down bolts used for shipping should be loosened so that compressor is floating freely on its isolator mounts. Excessive noise will occur if compressor has a broken valve or loose discharge tube. Replace compressor.
	Evaporator blower	Check for evap wheel hitting the housing. Adjust for clearance and alignment. Check for defective bearings. Repair or replace
	Contactors	A clattering or humming noise in contactor could be due to control voltages lower than 24 V. Check for low supply voltage, low transformer output or extra long runs of temperature control module. If contact pitted or corroded or coil is defective, replace.
	Rattles and vibrations	Check for loose screws, panels, or internal components. Tighten and secure. Copper piping could be hitting metal surfaces. Carefully readjust by bending slightly.

Chapter 9

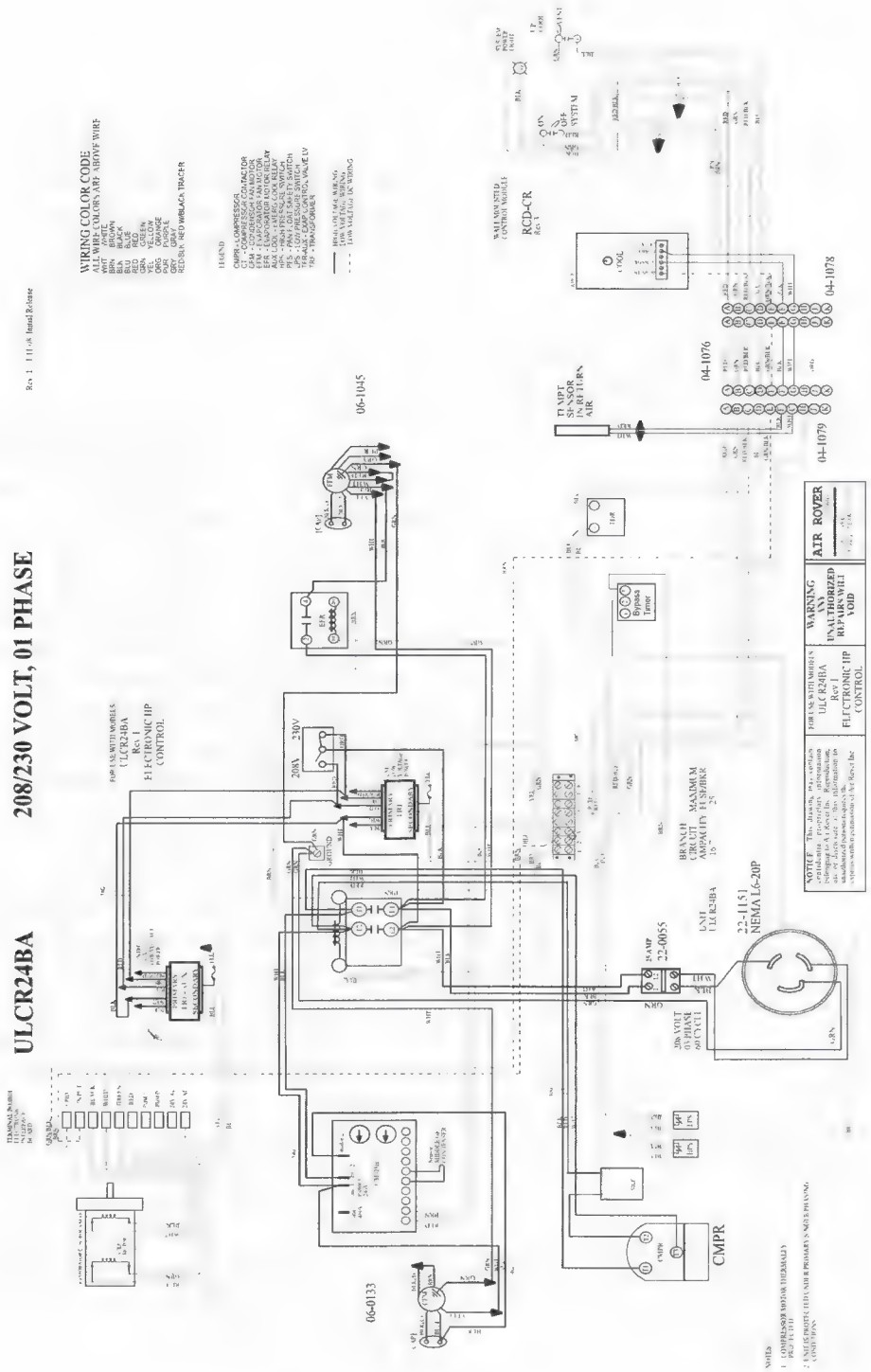
Spare Parts

Table 9-1. Recommended Spare Parts List for ULCR24BA

AIR ROVER #	Qty	UM	Description
01-2003	1	Each	FAN, CONDENSER
01-0012	1	Each	FAN, EVAPORATOR BLOWER
03-1145	1	Each	SCROLL COMPRESSOR
06-0134	1	Each	MOTOR, EVAPORATOR
06-0133	1	Each	MOTOR, CONDENSER
09-0451	2	Each	FILTER, CONDENSER 15.25 x 25 x 1
09-0116	1	Each	FILTER, EVAPORATOR 19 x 18.5 x 1
13-0009	1	Each	TEMPERATURE CONTROL BOARD
13-0033	1	Each	CONTROL, HEAD PRESSURE
17-1063	2	Each	VALVE, HOT GAS BYPASS
17-1084	1	Each	VALVE, THERMAL EXPANSION
17-1055	1	Each	VALVE, HOT GAS THERMAL EXP.
17-1070	1	Each	SIGHT GLASS
17-1071	1	Each	DRIER, FILTER
17-0045	1	Each	VALVE, ELECTRONIC SUCTION CONTROL
20-0016	1	Each	SWITCH, LOW PRESSURE CUTOUT
20-1017	1	Each	SWITCH, HIGH PRESSURE CUTOUT
04-0034	1	Each	CONTACTOR, 24 V, 3 POLE , 30A
04-0042	1	Each	RELAY, EVAPORATOR FAN
04-0053	1	Each	RELAY, COMPRESSOR TIME DELAY
04-0057	2	Each	TRANSFORMER, 75VA MANUAL RESET
13-0069	1	Each	JOHNSON CONTROL THERMOSTAT (SYSTEM 350) COOL

APPENDICES

Appendix A



ULCR24BA Electrical wiring diagram

Appendix B

Head Pressure Control Troubleshooting

PROBLEM	POSSIBLE CAUSE(S)	CORRECTIVE ACTION
Unit fails to start.	Sensor may not be connected or is defective.	With the probe disconnected, use an ohmmeter to measure the resistance between the probe wires. It should match the chart in Appendix C. If you read an OPEN or SHORT, replace the sensor.
Fuse and/or circuit blows.	The head pressure control has been miswired and may be permanently damaged.	If wiswired, correct wiring. If damaged, replace control.
Condenser fan cycles from full ON to full OFF with little or no modulation.	Hard start setting is wrong.	Turn OFF the control circuit power (24 VAC). Re-apply 24 VAC power and confirm hard start operation. Reduce the hard start period to the minimum setting required to accelerate the fan. Excessive hard starting causes large pressure drops by running too much cold air over the condenser. Should the cycling persist, move the probe up several bends into the condenser to increase the sensitivity to condensing temperature. Adjust probe location. Fine tune cutout adjustment.
Condenser fan does not come on at all.	The head pressure control is receiving insufficient or no power.	Using an AC voltmeter, measure the voltage between the 24 VAC terminals. It should read approximately 24 volts. Measure the line voltage between LINE 1 and LINE 2 to confirm that the line voltage is present. Remove the thermistor probe from the terminal block and measure its resistance at ambient temperature. Compare your reading at the appropriate temperature in Appendix C to see if the actual resistance approximates the listed value. Next, hold the probe in your hand and confirm that the resistance decreases. Place a temporary jumper across the S2 or S3 terminals. Fan should run at full speed. If it does, recheck probe connection and verify probe is operating correctly.
The high pressure switch trips off.	The head pressure control probe is not mounted at the proper location.	Move the probe further into the condenser where the temperature is higher. This will produce a higher fan RPM and will decrease the head pressure. Fine adjust the cutout and hard start settings.

Appendix C

Condenser Temperature vs. Head Pressure Control Probe Resistance

°Celsius	°Fahrenheit	Resistance (k Ω)
0	32	32.7
5	41	25.4
10	50	19.9
15	59	15.7
20	68	12.5
25	77	10.0
30	86	8.1
35	95	6.5
40	104	5.3
45	113	4.4
50	122	3.6

WARRANTY

One Year Parts Guarantee – Worldwide

If any part of your Air Rover Environmental Control Unit fails because of a manufacturing defect within a twelve month period from delivery date of purchase, Air Rover, Inc. will furnish without charge F.O.B. Tyler, Texas, the required replacement part. Any transportation, related service labor, diagnosis calls, filters, driers and/or refrigerant are not included.

Before Warranty transactions are executed, a written authorization number must be issued. For replacement parts, contact Air Rover, Inc. at (903) 877-3430 between 8:00am and 5pm central time Monday through Friday and request a Material Return Authorization (MRA) number. Authorization must be obtained before any replacement parts are shipped. Air Rover, Inc. will invoice the replacement part pending receipt of the defective part, preserved and labeled with the MRA number. Air Rover, Inc. will then credit the invoice for the price of the replacement part.

90 Day Service Guarntee - CONUS, Canada, and Mexico

All service labor charges and/or diagnostic call charges must be authorized prior to commencement of the service. To obtain service under this warranty, the customer must contact the Air Rover, Inc. Service Department at (903) 877-3430 between 8 a.m. and 5 p.m. central time Monday through Friday and request a Service Repair Authorization (SRA) Number. Also, authorization must be obtained before any replacement parts, other than those provided by Air Rover, Inc. are installed.

This 90 Day Service Guarntee applies to products purchased and retained for use in the United States, as well as units shipped for use in Canada and Mexico. Units used in the aforementioned countries are honored under the Air Rover, Inc.'s standard 90 Day Service and One Year Parts Gurantee. Air conditioning units used for rental purposes are not covered by this warranty.

Further Warranty Information

THIS WARRANTY does not cover damages caused by improper installation, misuse of equipment or negligent servicing. Units that are to be used where ambient outside temperatures will be less than 45° F are not covered by this warranty unless said units are equipped with optional low ambient controls.

THIS WARRANTY constitutes the exclusive remedy of any purchaser of Air Rover, Inc. Portable Air Conditioners and is in lieu of all other warranties, expressed or implied, including, without limitation, any implied warranty or merchantability of fitness for use, to the fullest extent permitted by law. In no event shall Air Rover, Inc. be liable for incidental or consequential damages.

THIS WARRANTY gives you specific legal rights, and you may also have other rights which vary from state to state and county to country. Some states and countries do not allow limitations or exclusions, so the above limitations or exclusions may not apply in these cases.

AIR ROVER, INC. – Tyler, Texas WARRANTOR

AIR ROVER®
INC.

Call (800)-877-9287 or (903)-877-3430 for support
GSA# GS-21F-0090H/ CAGE CODE# 0C1U1/ DUNS# 182737262/ Email: acinfo@airrover.com
Small Business, Woman-Owned / ISO 9001:2008 Certification Pending

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